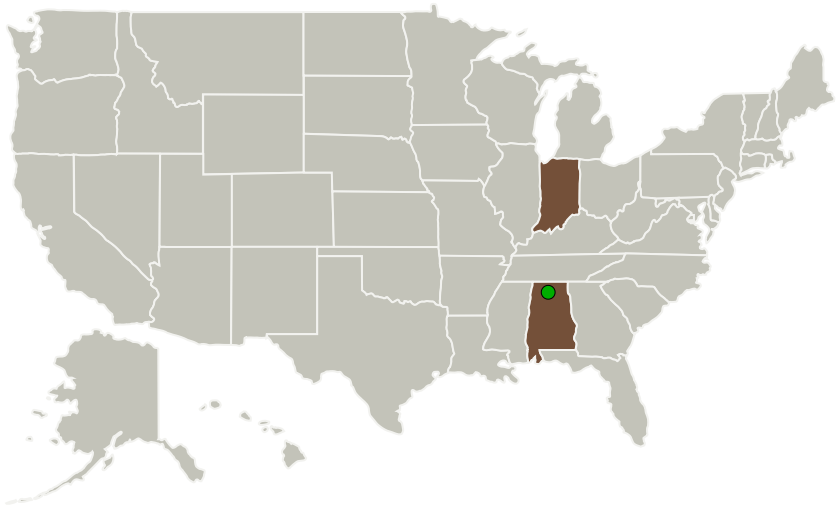
Sintered Inductive Metal Printer with Laser Exposure, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

The proposed innovation is a 3D metal printer, which offers the unique ability to fabricate metal components and tools in space. The proposed system will accomplish this task through the utilization of a two-stage filament melting process whereby a metallic filament is first heated to Curie temperature through induction and then deposited on a build platform where it is fused to the previous layer by exposure to a low energy laser. This new unique process is known as Sintered Metal Printing with Laser Exposure (SIMPLE). Induction heating is not entirely new to Fused Deposition Manufacturing (FDM). There has been recent research into the integration of an induction coil into the "hot end" of a plastic filament FDM printer. The induction coil surrounds the metal nozzle, known as the "hot end" and inductively heats the nozzle when an AC current is applied. The nozzle then heats and melts the plastic filament allowing it to be extruded onto a platform where a part is formed. The use of induction heating, when printing with a metal filament, is similar but the induction coil heats the wire filament directly as it passes through its center. This system offers faster melt times resulting in faster feed rates, lower mass resulting in quicker more accurate printer head movements and lower overall power consumption. Conceptually, the wire filament will not be heated to melting but heated to the Curie temperature and laid as a hot filament on the build platform. To gain adherence between deposited layers, a low energy laser is used simultaneous to the layering process to heat and fuse adjacent filament layers.

Primary U.S. Work Locations and Key Partners



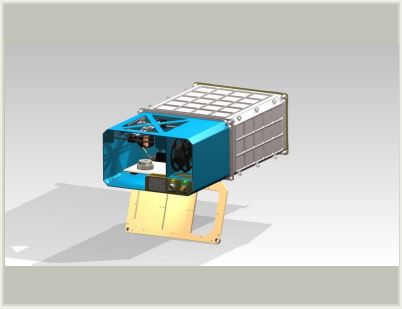


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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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Completed Technology Project (2016 - 2016)

Organizations Performing Work	Role	Type	Location
Techshot, Inc.	Lead Organization	Industry	Greenville, Indiana
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Indiana

Project Transitions

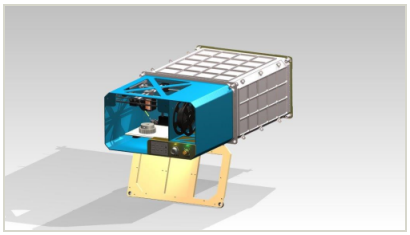
June 2016: Project Start

December 2016: Closed out

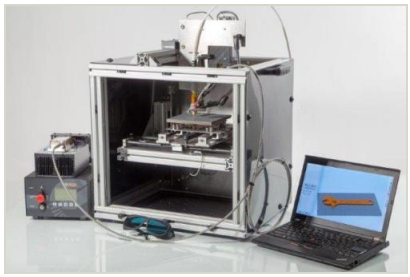
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139696)*

Images



Briefing Chart Image
Sintered Inductive Metal Printer with Laser Exposure, Phase I
(https://techport.nasa.gov/image/131302)



Final Summary Chart Image
Sintered Inductive Metal Printer with Laser Exposure, Phase I Project Image
(https://techport.nasa.gov/image/133305)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Techshot, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

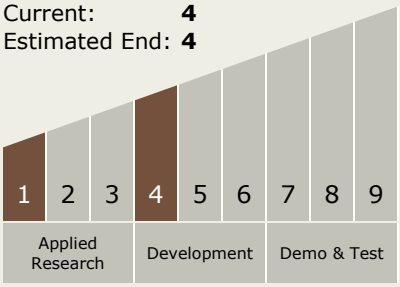
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Eugene D Boland

Technology Maturity (TRL)

Start: **1**
Current: **4**
Estimated End: **4**



Sintered Inductive Metal Printer with Laser Exposure, Phase I

Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System